

WHAT IS CLAIMED IS:

1. An apparatus for embedding a watermark into contents data, comprising:
 - 5 pattern generating means for generating bits representing a predetermined bit pattern corresponding to a watermark;
 - specified-bit detecting means for detecting bits in original picture data as specified bits into which a watermark can be embedded;
 - 10 calculating means for calculating a desired bit pattern represented by the specified bits in response to the predetermined bit pattern and a specified bit pattern, wherein the desired bit pattern can be converted into the specified bit pattern by given logical operation with the predetermined bit pattern; and
 - 15 mixing means for changing the specified bits to represent the desired bit pattern to convert the original picture data into watermark-embedded picture data.
2. An apparatus as recited in claim 1, wherein the
- 20 predetermined bit pattern and the specified bit pattern remain unchanged when being rotated through one of 90, 180, and 270 degrees.
3. A method of embedding a watermark into contents data,
- 25 comprising the steps of:
 - generating bits representing a predetermined bit pattern

corresponding to a watermark;

detecting bits in original picture data as specified bits into which a watermark can be embedded;

calculating a desired bit pattern represented by the specified
5 bits in response to the predetermined bit pattern and a specified bit pattern, wherein the desired bit pattern can be converted into the specified bit pattern by given logical operation with the predetermined bit pattern; and

changing the specified bits to represent the desired bit
10 pattern to convert the original picture data into watermark-embedded picture data.

4. A method as recited in claim 3, wherein the predetermined
15 bit pattern and the specified bit pattern remain unchanged when being rotated through one of 90, 180, and 270 degrees.

5. An apparatus for reproducing a watermark from watermarked contents data, comprising:

pattern generating means for generating bits representing a
20 predetermined bit pattern;

operation means for selecting specified bits among bits in watermark-added picture data, for repetitively changing the currently-selected specified bits from ones to others, and for
executing given logical operation between the predetermined bit
25 pattern and a bit pattern represented by the currently-selected specified bits;

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embedding-position detecting means for deciding whether or not a result of the given logical operation is equal to a specified bit pattern, and for, when the result of the given logical operation is equal to the specified bit pattern, deciding that the currently-

5 selected specified bits correspond to a watermark-embedded region; and

converting means for changing one of a luminance and a color hue represented by a portion of the watermark-added picture data which corresponds to one of the watermark-embedded region and a
10 region adjoining the watermark-embedded region.

6. An apparatus as recited in claim 5, wherein the predetermined bit pattern and the specified bit pattern remain unchanged when being rotated through one of 90, 180, and 270
15 degrees.

7. A method of reproducing a watermark from watermarked contents data, comprising the steps of:

generating bits representing a predetermined bit pattern;

20 selecting specified bits among bits in watermark-added picture data;

repetitively changing the currently-selected specified bits from ones to others;

executing given logical operation between the predetermined
25 bit pattern and a bit pattern represented by the currently-selected specified bits;

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deciding whether or not a result of the given logical operation is equal to a specified bit pattern;

when it is decided that the result of the given logical operation is equal to the specified bit pattern, deciding that the
5 currently-selected specified bits correspond to a watermark-embedded region; and

changing one of a luminance and a color hue represented by a portion of the watermark-added picture data which corresponds to one of the watermark-embedded region and a region adjoining the
10 watermark-embedded region.

8. A method as recited in claim 7, wherein the predetermined bit pattern and the specified bit pattern remain unchanged when being rotated through one of 90, 180, and 270 degrees.
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9. An apparatus for embedding a watermark into contents data, comprising:

pattern generating means for generating bits representing a fixed bit pattern;

20 embedding-position deciding means for deciding a watermark-embedding position with respect to original picture data;

random-number generating means for generating random-number data representing a random number;

25 calculating means for calculating a desired bit pattern represented by specified bits in response to the fixed bit pattern

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and a specified bit pattern, the specified bits being among bits in a first portion of the original picture data which corresponds to the watermark-embedding position, wherein the desired bit pattern can be converted into the specified bit pattern by given logical operation

5 with the fixed bit pattern;

operation means for executing given logical operation between watermark data and the random-number data; and

mixing means for changing the specified bits to represent the desired bit pattern, and for embedding a result of the given logical

10 operation in a second portion of the original picture data which corresponds to the watermark-embedding position and which adjoins the first portion of the original picture data.

10. An apparatus as recited in claim 9, wherein the watermark-embedding position is composed of sub positions dispersing in a

15 frame.

11. An apparatus as recited in claim 9, wherein the embedding-position deciding means comprises means for dividing the original

20 picture data into equal-size blocks, means for calculating a degree of a complexity of a picture portion represented by each of the equal-size blocks, means for selecting ones among the equal-size blocks which correspond to calculated complexity degrees equal to or greater than a prescribed value, and means for deciding the

25 watermark-embedding position in response to the selected ones of the equal-size blocks.

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12. A method of embedding a watermark into contents data, comprising the steps of:

- generating bits representing a fixed bit pattern;
- 5 deciding a watermark-embedding position with respect to original picture data;
- generating random-number data representing a random number;
- calculating a desired bit pattern represented by specified bits
- 10 in response to the fixed bit pattern and a specified bit pattern, the specified bits being among bits in a first portion of the original picture data which corresponds to the watermark-embedding position, wherein the desired bit pattern can be converted into the specified bit pattern by given logical operation with the fixed bit
- 15 pattern;
- executing given logical operation between watermark data and the random-number data; and
- changing the specified bits to represent the desired bit pattern, and embedding a result of the given logical operation in a
- 20 second portion of the original picture data which corresponds to the watermark-embedding position and which adjoins the first portion of the original picture data.

13. An apparatus for reproducing a watermark from watermarked contents data, comprising:

 pattern generating means for generating bits representing a

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fixed bit pattern;

random-number generating means for generating random-number data representing a random number;

first operation means for selecting specified bits among bits in
5 watermark-added picture data, for repetitively changing the currently-selected specified bits from ones to others, and for executing given logical operation between the fixed bit pattern and a bit pattern represented by the currently-selected specified bits;

embedding-position detecting means for deciding whether or
10 not a result of the given logical operation by the first operation means is equal to a specified bit pattern, and for, when the result of the given logical operation by the first operation means is equal to the specified bit pattern, deciding that the currently-selected specified bits correspond to a first part of a watermark-embedded
15 position; and

second operation means for executing given logical operation between the random-number data and a portion of the watermark-added picture data which corresponds to a second part of the watermark-embedded position different from the first part thereof
20 to reproduce watermark data from the watermark-added picture data.

14. A method of reproducing a watermark from watermarked contents data, comprising the steps of:
25 generating bits representing a fixed bit pattern;
generating random-number data representing a random

number;

selecting specified bits among bits in watermark-added picture data;

repetitively changing the currently-selected specified bits

5 from ones to others;

executing given logical operation between the fixed bit pattern and a bit pattern represented by the currently-selected specified bits;

10 deciding whether or not a result of the given logical operation is equal to a specified bit pattern;

when the result of the given logical operation is equal to the specified bit pattern, deciding that the currently-selected specified bits correspond to a first part of a watermark-embedded position; and

15 executing given logical operation between the random-number data and a portion of the watermark-added picture data which corresponds to a second part of the watermark-embedded position different from the first part thereof to reproduce watermark data from the watermark-added picture data.

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15. An apparatus for embedding a watermark into contents data, comprising:

pattern generating means for generating bits representing a fixed two-dimensional bit pattern;

25 embedding-position deciding means for deciding a two-dimensional watermark-embedding region with respect to original

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picture data;

random-number generating means for generating random-number data representing a random number;

calculating means for calculating a desired two-dimensional
5 bit pattern represented by specified bits in response to the fixed
two-dimensional bit pattern and a specified two-dimensional bit
pattern, the specified bits being among bits in a first portion of the
original picture data which corresponds to a first part of the two-
dimensional watermark-embedding region, wherein the desired
10 two-dimensional bit pattern can be converted into the specified
two-dimensional bit pattern by given logical operation with the fixed
two-dimensional bit pattern;

operation means for executing given logical operation between
watermark data and the random-number data; and

15 mixing means for changing the specified bits to represent the
desired two-dimensional bit pattern, and for embedding a result of
the given logical operation in a second portion of the original
picture data which corresponds to a second part of the two-
dimensional watermark-embedding region different from the first
20 part thereof.

16. An apparatus as recited in claim 15, wherein the first part of
the two-dimensional watermark-embedding region is a central part
thereof, and the second part of the two-dimensional watermark-
25 embedding region is an outer part thereof which surrounds the
central part thereof.

17. An apparatus as recited in claim 15, wherein the two-dimensional watermark-embedding region corresponds to a portion of the original picture data which represents one of (1) a picture
5 portion having a degree of a complexity equal to or greater than a prescribed value and (2) a picture portion including a contour.
18. An apparatus as recited in claim 15, wherein the fixed two-dimensional bit pattern and the specified two-dimensional bit
10 pattern remain unchanged when being rotated through one of 90, 180, and 270 degrees.
19. A method of embedding a watermark into contents data, comprising the steps of:
15 generating bits representing a fixed two-dimensional bit pattern;
deciding a two-dimensional watermark-embedding region with respect to original picture data;
generating random-number data representing a random
20 number;
calculating a desired two-dimensional bit pattern represented by specified bits in response to the fixed two-dimensional bit pattern and a specified two-dimensional bit pattern, the specified bits being among bits in a first portion of the original picture data
25 which corresponds to a first part of the two-dimensional watermark-embedding region, wherein the desired two-

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dimensional bit pattern can be converted into the specified two-dimensional bit pattern by given logical operation with the fixed two-dimensional bit pattern;

executing given logical operation between watermark data and

5 the random-number data; and

changing the specified bits to represent the desired two-dimensional bit pattern, and embedding a result of the given logical operation in a second portion of the original picture data which corresponds to a second part of the two-dimensional watermark-

10 embedding region different from the first part thereof.

20. A method as recited in claim 19, wherein the fixed two-dimensional bit pattern and the specified two-dimensional bit pattern remain unchanged when being rotated through one of 90,

15 180, and 270 degrees.

21. An apparatus for reproducing a watermark from watermarked contents data, comprising:

pattern generating means for generating bits representing a

20 fixed two-dimensional bit pattern;

random-number generating means for generating random-number data representing a random number;

first operation means for selecting specified bits among bits in watermark-added picture data, for repetitively changing the

25 currently-selected specified bits from ones to others, and for

executing given logical operation between the fixed two-dimensional

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embedding-position detecting means for deciding whether or not a result of the given logical operation by the first operation

second operation means for executing given logical operation between the random-number data and a portion of the watermark-added picture data which corresponds to the two-dimensional watermark-embedded region to reproduce watermark data from the watermark-added picture data.

22. An apparatus as recited in claim 21, wherein the embedding-position detecting means comprises means for, when the result of the given logical operation by the first operation means is equal to the specified two-dimensional bit pattern, deciding that the currently-selected specified bits correspond to a first part of the two-dimensional watermark-embedded region, and the second operation means comprises means for executing given logical operation between the random-number data and a portion of the watermark-added picture data which corresponds to a second part of the two-dimensional watermark-embedded region different from the first part thereof to reproduce watermark data from the

watermark-added picture data.

23. An apparatus as recited in claim 21, wherein the fixed two-dimensional bit pattern and the specified two-dimensional bit
5 pattern remain unchanged when being rotated through one of 90, 180, and 270 degrees.

24. A method of reproducing a watermark from watermarked
contents data, comprising the steps of:
10 generating bits representing a fixed two-dimensional bit
pattern;
generating random-number data representing a random
number;
selecting specified bits among bits in watermark-added
15 picture data;
repetitively changing the currently-selected specified bits
from ones to others;
executing given logical operation between the fixed two-
dimensional bit pattern and a two-dimensional bit pattern
20 represented by the currently-selected specified bits;
deciding whether or not a result of the given logical operation
is equal to a specified two-dimensional bit pattern;
when the result of the given logical operation is equal to the
specified two-dimensional bit pattern, deciding that the currently-
25 selected specified bits correspond to a two-dimensional watermark-
embedded region; and

executing given logical operation between the random-number data and a portion of the watermark-added picture data which corresponds to the two-dimensional watermark-embedded region to reproduce watermark data from the watermark-added picture

5 data.

25. A method as recited in claim 24, wherein the fixed two-dimensional bit pattern and the specified two-dimensional bit pattern remain unchanged when being rotated through one of 90,

10 180, and 270 degrees.

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